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CRISIS MITIGATION OF DISAPPEARING PRIVATE GREEN SPACES THROUGH SUSTAINABLE SOLUTIONS - CASE STUDY IN BAGHDAD (IRAQ)

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Abstract

he study discussed a group of factors that led to the fading of private green spaces within residential units in Baghdad for different periods (2005-2022), as well as the impact of this change on the city's ecosystem as it is a part of a more extensive system (such as parks, public green spaces, river banks, etc.), in terms of providing thermal and aesthetic comfort that the green cover adds to the housing units, whose impact is reflected on the urban landscape of the residential areas. The research hypothesis adopts the selection of samples from residential neighbourhoods in Baghdad to measure the extent of the shortage of green spaces by using the research methodology in a method (Cumulative method) by calculating the proportion of green spaces for housing units for different years from 2005 - to 2010- 2015 - 2022 and explanations that led to this decrease in private green spaces within housing units, and develop recommendations to compensate green spaces within housing units by adopting sustainable green architecture methods and adopt sustainable solutions to reduce the shortage of green spaces within residential areas.

Keywords: Green Spaces, Sustainable Houses, Green Architecture, Cumulative Method, Baghdad.

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INTRODUCTION

Baghdad, Iraq's capital, has an area of (840 km2) and a population of 7,682,13 in the year 2021 (CSO, 2021) , Baghdad is located on the Tigris River at latitude 33 and longitude 44. (Map 1). It is located in the centre of the country, split by the Tigris River into two parts: eastern (Rasafa) and western (Karkh) (wikipedia, 2022). The city has proliferated in the previous 50 years, with the introduction of several new neighbourhoods expanding the physical fabric (Razzaq, 2013) .

The population pressure and the absence of strategic housing plans for the state and with the announcement of the Ministry of Planning, according to the National Development Plan Republic of Iraq- Ministry of Planning of the five-year strategy 2018-2022 (Planning, 2018-2022), that the need continues to fill the housing deficit, which reached 2.5 million housing units at the end of 2016 (50% in the cities of Baghdad and Nineveh) (bank, 2018).

All of these factors have led to pressure on the green land areas for demarcation by the owners and the establishment of smaller housing units, and the disappearance of private gardens (AL-Taie, 2019) , which were considered a design criterion calculated within the basic plan of the city of Baghdad with a standard of 12 m2 / person, which represents 40% of the total green areas within the city Baghdad. (Al-Badri, 2013)

The development that the residential neighbourhoods noticed, especially after the establishment of the basic plan for the city of Baghdad for the year 1973 by Polservice (Polservice, 1973) (Stanek, 2017). Development, where the neighbourhoods were expanded by distributing residential lands with areas of 600 and 300 m and 150 square meters and with different building coverage areas according to the size of the plot as shown in Table 1 below (Baghdad, 2022) :

(Table 1) The percentage of building coverage concerning For open space within the area of a single plot area

Area in square meters	Construction persantage
240	80%
241-400	65%
401-600	60%
601- 800	55%

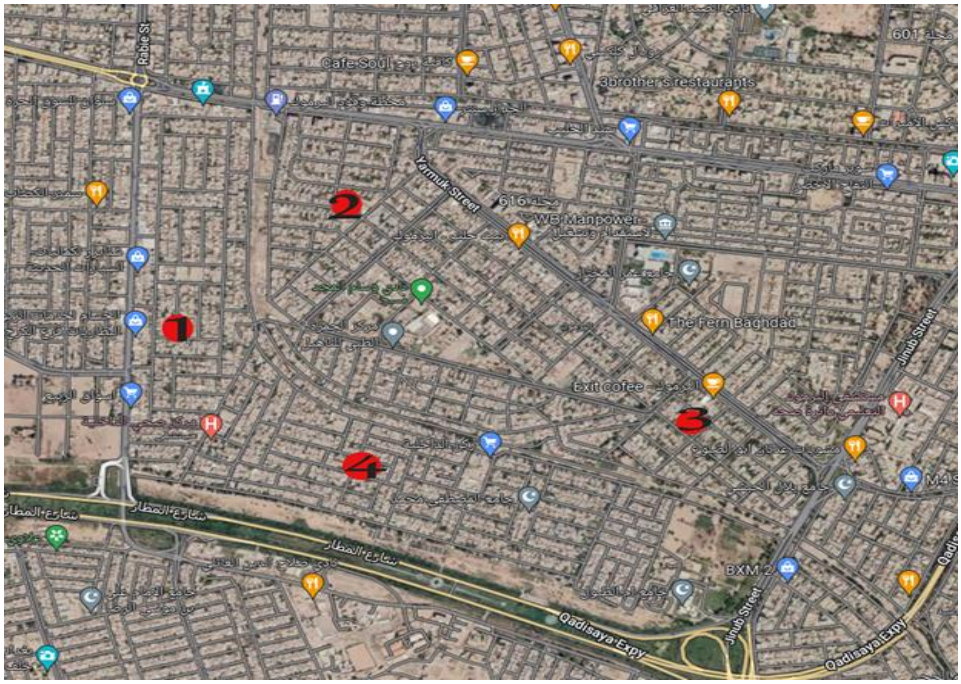
From the above table, we note that 45% of the area of the plot is calculated as open space as it is within the residential units with an area of more than 600 square meters, which are found in most areas of Karkh such as Yarmouk, Al-Mamoun, Al-Mansour and others. He gave it a standard (12 m 2 / inhabitants), which represents (40%) of the total area of green urban spaces throughout the city of Baghdad (Al-Badri, 2013), although the green spaces of home gardens are not counted within the spaces and are not mentioned by the planning standards and are not included in the calculation of the green spaces in City (Council, 2011) .

The sixties and seventies of the past century were distinguished by the vastness of the gardens, where the residential land area ranged between (400-600 m2) and the most minor area for the home garden was more than (200 m²) (Ihsan Fathi, 1986), but due to the absence of oversight and broken or ill-thought-out laws led to the re-segregation of large residential units into smaller units and Therefore, home gardens did not have a significant impact on improving the environment and climate conditions, or even for entertainment purposes due to occupying most of the open spaces in the residential areas in the form of car parks, and when the area of the residential land was (600 m2), the area of what was built in it did not exceed (300 m2) and the remaining (300 m2) of it was at least (240 m2) as green spaces and gardens With an average family rate of 6 members, the individual share of the garden is (40 m 2 / person), while it was divided into smaller plots, so the total built-up area reached (450 m2) and the remaining (150 m2) of it at most (100 m 2) as private gardens, while the number of occupants became The original plot became at least (10 people), meaning that the per capita share decreased by (65%), meaning that the garden standard became (12 m 2 / person) and when it is calculated for the general population of the city, today there is the house (4 m 2 / person). (Al-Badri, 2013) , The research displays that the reasons for this problem in the change in the standard of green areas are the decrease in the planning and design standard level for the planned housing areas and the lack of development and improvement for the

random housing development areas. (Al-Essawi, 2006).

1- METHOD AND MATERIALS OF A CASE STUDY OF THE PRIVATE GREEN SPACES IN THE YARMOUK AREA IN BAGHDAD

The Yarmouk area was chosen to study the case of the divisions of housing units and the reduction of green spaces within them from 2005 to 2022, where it was noted that the division did not witness a specific part of the residential neighbourhood but rather included all the residential shops that make up the Yarmouk area and include the locality of 618, 616, 614 and 612, where Plots of land characterise these shops from 620 - 650 square meters and a coverage rate of 55% (Baghdad, 2022).



(Pic. No. 1) Redpoint represents the location of the residential blocks selected for study in the Yarmouk region – Baghdad)

It was observed in the research using the cumulative system (Shamsul A. Bakar, 2019)for calculating the ratios. The shrinking of green areas is at the expense of the increase in the building areas. Furthermore, as shown in the table with proportions and numbers. As shown in Table No. 2:

Tabel No. 2 area of each area case study

Area	2005		2022
	Green Area m2		Green Area m2
1	8800		5100
2	A	8200	3250
	B	8700	5900
3	9500		5000
4	3000		900

1- Area 1

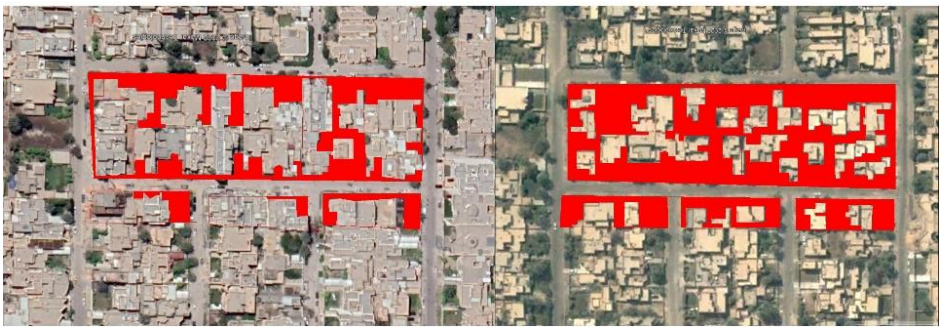
It is noticed from Google Maps images that the green space area decreased after 2010, as shown in the plan (Pic No. 2), (Pic. No.3).

Area 1

2005 2022

2015 2022

(Pic No. 2) Google Maps images during the period 2005-2022

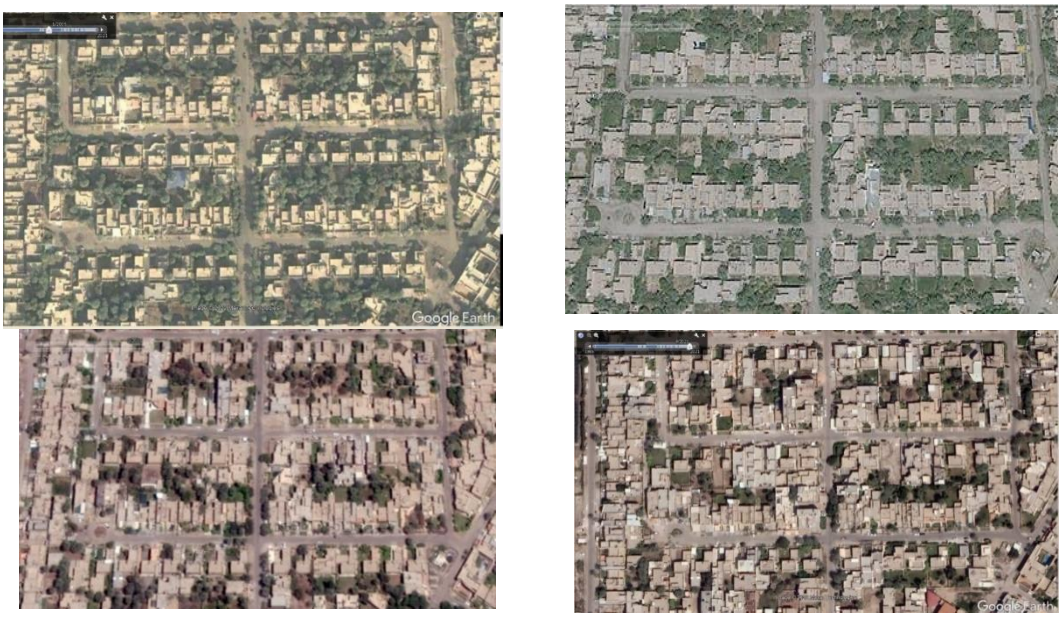


(Pic No. 3) Notice diminish in green areas is observed during the period 2005 -2022

2- Area 2

It is noticed from Google Maps images that the green space area decreased after 2010, as shown in the plan in sections **A and B**, see pic. No.4,5

2005 2015



2010 2022

(Pic. No. 4) Google Maps images during the period 2005-2022

2010 2022

(Pic. No. 5) Notice diminish in green areas is observed during the period 2005 -2022

3- Area 3

is noticed from Google Maps images that the area of green spaces has decreased after 2010, as shown in the plan see pic. No.6 and No.7

2005 **2022**

(Pic. No. 6) Google Maps images during the period 2005 -2022

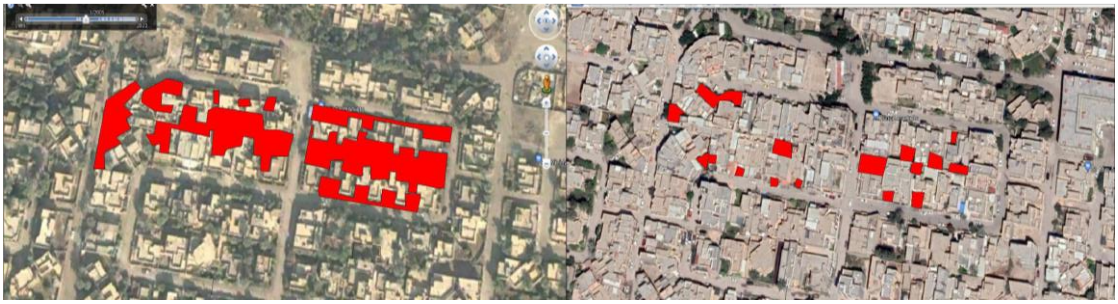
2005 2022

(Pic. No. 7) Notice diminish in green areas is observed during the period.

4- Area 4

is noticed from Google Maps images that the area of green spaces has decreased after 2010, as shown in the plan see pic. No.8 and No. 9

2005 2022



2010 2022

(Pic. No. 6) Notice diminish in green areas is observed during the period.

2- CONCLUSIONS AND RESULTS

It is noted in the results that showed in table 3

From the research methodology, the apparent reduction of the green areas of the selected samples was observed:

1- In area 1, the area of the green areas decreased from 8800 square meters to 5100 square meters or about 43%.

2- Area 2 :

- zone **A** of the green areas decreased from 8200 square meters to 3250 square meters or about 61%
- zone **B** of the green areas decreased from 8700 square meters to 5900 square meters or about 32%

1- In area 3, the area of the green areas decreased from 9500 square meters to 5000 square meters or about 47%.

2- Area 4, the area of the green areas decreased from 3000 square meters to 900 square meters or about 81%.

It is noted from the results that the most reduction in area. No. 4 that the green spaces had economic value due to their proximity to a commercial centre.

It is noted in the results that showed in table 4 :

Area	2005		2022	The rate of reduction
	Green Area m2		Green Area m2	Percentage
1	8800		5100	% 43
2	A	8200	3250	%61
	B	8700	5900	%32
3	9500		5000	%47
4	3000		900	%81

The perimeter of the selected areas was calculated and approved the perimeter of the facades of the buildings (P) with the height of the buildings (H) for two floors for each floor at a rate of 3 meters, to use the resulting area of the calculation process and use it to apply one of the techniques of green architecture, which is the vertical gardens (Vg) see picture No.7,

Vg = P*H H=3M for one hight floor

(Pic. No. 7) Web resourc techniques of green architecture by uesing vertical gardens- Paris

That the calculated vertical areas replaced part of the horizontal green areas that disappeared as a result of their transformation into buildings, It was noted from the effects that the use of vertical gardens had compensated more than what was lost by the horizontal green spaces in each of the 1 and 2 areas, but in both regions, 3 and 4, the compensation approached the limit of 90%, as shown in table no.4

Table 4 The rate of compensation of green spaces

Area	2005		2022	perimeter of façade (P)	Compensation Vg = P*H	Percentage of Compensation
	Green Area m^2		Green Area m^2	m	Vertical area m^2	%
1	8800		5100	1100	6600	132%
2	A	8200	3250	1000	6000	112%
	B	8700	5900	1000	6000	136%
3	9500		5000	647	3882	93%
4	6600		1244	735	4410	86%

3- RECOMMENDATIONS

According to what was noted by the cumulative calculations provided by the research for the area of green spaces in 2005 and its change until the region witnessed an override of those areas and their current status in 2022 and their disappearance in some residential blocks, this indicates the urgent need to identify recommendations to avoid this shortage. It is among the green architecture treatments and sustainable solutions within the cities :

1 - Provide an area of green vertical gardens on the facades of buildings, with the height of the facades, which are 3 to two floors in residential units with facades of more than five meters

2- Providing areas for rooftop gardens for residential units with facades that are less than 5 meters

3- Emphasis on planting and afforestation sidewalks to provide comfort and freedom for pedestrians on the street and the slab

From these recommendations, the research concludes the urgent need to address the shortage of green spaces and their environmental and thermal impact on the region, thus reflecting its impact on the environment in general.

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